ARCHITECTURAL PROGRAM

National Institute for Aviation Research (NIAR)

Crash Dynamics Laboratory

August 2017

FY 2018 Capital Project Request

Wichita State University

Office of Facilities Planning

WICHITA STATE UNIVERSITY

NIAR_CRASH DYNAMICS LABORATORY
ARCHITECTURAL PROGRAM

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INTRODUCTION

The National Institute for Aviation Research (NIAR) Crash Dynamics Laboratory at Wichita State University is a premier dynamic sled testing facility providing research, training, development testing, and certification of aircraft and non-aviation components under dynamic impact conditions. Established in 1992 and updated in 2005, the Crash Dynamics Laboratory now currently encompasses 10,000 square feet and is housed in an indoor temperature and humidity controlled environment. This laboratory plays a pivotal role in NIAR's Aerospace Crashworthiness Research and Development program. Through the years NIAR has become the premiere facility supporting aerospace crashworthiness research for industry and government organizations worldwide.

The focal piece of equipment in the Crash Dynamics Laboratory (CDL) is the Dynamic Sled System (DSS). The original system from 1992 to 2005 was a decelerator type Dynamic Sled System; deceleration driven sled technology was used in the early days of aerospace and automotive dynamic testing. The disadvantages of this type of sled configuration were mainly poor repeatability of test pulses, the complexity of testing different crash conditions, and the long setup times between dynamic tests. With the evolution of dynamic sled testing in the automotive industry new dynamic test equipment and technologies were developed in the late 90's. The Crash Dynamics Laboratory at Wichita State University was upgraded in 2005 with an accelerator servo hydraulic sled system manufactured by MTS [MTS Model 888.20]. This system has enabled NIAR, for the last 12 years, to conduct state of the art research to support academia, industry, and government agencies to improve the level of safety for various modes of transportation. NIAR-WSU researchers have conducted crashworthiness research for aerospace, automotive, mass transit [Buses and Light Rail Vehicles], military, and child safety applications. The research has been sponsored and supported by federal agencies (Federal Aviation Administration, Federal Transit Administration), the State of Kansas, the National Science Foundation, and over 50 industry partners from 13 different countries worldwide.

Since 2005, the Crash Dynamics Laboratory has provided over 200 WSU students and visiting research scholars from numerous universities\research institutes worldwide with an opportunity to conduct research in the field of dynamic sled testing for various aerospace, mass transit, and automotive applications. The training acquired in this lab by the students has proven instrumental for industry once the students transition to employment at various aircraft OEMS and suppliers.

Since 1993, the Federal Aviation Administration has continuously funded research programs that provide the scientific basis to develop future safety requirements and methods necessary to streamline the aerospace crashworthiness certification processes while improving occupant safety. The laboratory is frequently used by industry to conduct development and certification programs; this industry participation ensures the income required for the operation and maintenance of these test facilities.

The main systems [electronics and hydraulics] that are used in the construction of the current MTS servo hydraulic Sled System are approaching the end of their useful life. MTS and their suppliers are no longer

supporting changes or upgrades to the current sled systems. The new proposed Dynamic Sled System, the HyperGplus 220, not only provides a replacement for the current system but also has additional system performance features [double payload capability and increased deceleration levels] that will enable NIAR-WSU to conduct research in additional emerging transportations fields such as space capsule crashworthy seat design, high-speed impact automotive applications, side impact, and mass transit safety for multiple occupant configurations (high payload configurations).

The caveat of the new HyperGplus 220 system is that the overall length of the system is 20 feet longer than the current MTS system. While retrofitting the HyperGplus 220 system into the current Crash Dynamics laboratory space has been thoroughly researched, none of the options will be viable. The currently laboratory space would need to be extended from the back of the building; however, this would encroach into a 30 foot easement for the main city waterline as well as electrical and gas lines. The space of the current laboratory and building layout do not allow for installation of the HyperGplus 220 system with enough track length to operate.

NIAR is requesting to build a new facility to house the Crash Dynamics Laboratory. The facility would have a base footprint of 13,500 sq. ft. (150 ft x 90 ft). The building would be focused around the sled system, with sufficient length to operate the HyperGplus 220 sled system and to easily provide maintenance on a yearly basis. The building would house two client specific areas composed of a conference room, work area, and test article preparation room. Office space and the control room will utilize one corner of the building with the potential of adding a second floor in this area. The remaining space will be used for the ATD (crash test dummy) calibration laboratory and component test fixtures. The goal of this building will be to provide clients with coupon to full scale testing capabilities. While the major focus will be the dynamic sled testing, most areas will be dual purpose for additional types of testing, such as UAS Ground Collision. Another main goal of this facility would be to provide more research and development work into testing methodologies, procedures, and processes with new technology to provide more efficient test protocols to clients. This new facility will enable the lab to expand its testing capabilities to support automotive clients.

PROJECT SCOPE

This facility is planned to be sited at the northwest corner of Oliver St. and the 18th street entrance. The facility will be designed with the Dynamic Sled System as the focal piece of equipment. Additional spaces in the building will be required as shown in the space summary in this program.

The design and construction of the facility will produce a permanent single-story structure. There will be an open single-story bay approximately 25'-0" high to accommodate the sled system. Two sets of stairs leading to a catwalk along the exterior wall will be required for circulation needs when testing setup is in progress. The potential to add future second floor spaces along the exterior walls flanking the sled bay should be factored into the design. Overhead doors will be required at the "Prep 1" and "Prep 2" areas as well as the sled system bay. A concrete surface drive will be needed to access the overhead doors in these areas.

The structure will be complete, with the appropriate exterior and interior finishes, lighting, power and mechanical systems, parking and egress for the disabled, drainage systems, interior and exterior signage, and landscaping to provide a complete, functional, relatively maintenance-free and aesthetically pleasing facility. The exterior finishes shall be consistent with the quality and appearance of the recently completed Partnership Building 1 (Airbus) building. It is anticipated that 30 parking spaces will be needed.

The consultant shall review the specific requirements for the Dynamic Sled System and testing criteria. These specific requirements will include electrical, mechanical and structural. The building will be temperature and humidity controlled to meet the parameters of the sled system. The floor slab design will need to be designed to work cohesively with the concrete reaction mass structural system. The concrete reaction mass design will be provided by the manufacturer providing the sled. The G.C. will be responsible for the construction of the concrete reaction mass.

SPECIAL REQUIREMENTS

The consultant shall utilize specialized expertise of the engineering/consulting firm's layout, design, structural design, as well as the knowledge and experience in the selection of the most cost-effective details such as materials, and construction methods. The facility shall be designed and constructed to be as maintenance free as possible within the funds available.

It should be emphasized that the accuracy of construction estimates is critical to the successful completion of this project. The University expects that the project bid documents must have assurance of the ability to award a construction contract to provide the minimum requirements listed in the project description above. The documents shall further be structured to include bid alternates that will permit award of a construction contract. Estimates for the concrete reaction mass and sled system will be provided by NIAR.

PROJECT FUNDING

This project will be funded from a combination of 1) NIAR restricted use funds (generated from industry revenues) and 2) grant funds.

PROJECT SCHEDULE

Completion of the facility at the earliest possible date is essential. Therefore, the project consultants must meet all target dates and deadlines agreed upon with the University and defined at the initiation of design services. A projected schedule is included within this document.

COST OF SERVICING BUILDING

The cost of servicing the building will be provided through NIAR restricted use funds.

NIAR_Crash Dynamics Laboratory

Space Summary

Area ID	Square Footage
Dynamic Sled Bay	5000 s.f.
Prep 1 - Test Article Preparation Room	900 s.f.
Prep 1 - Work Area	550 s.f.
Prep 1 - Conference Room	250 s.f.
Prep 2 - Test Article Preparation Room	900 s.f.
Prep 2 - Work Area	550 s.f.
Prep 2 - Conference Room	250 s.f.
Prep 3 - Test Article Preparation Room	600 s.f.
Prep 3 - Conference Room	75 s.f.
Fixture Storage & Machine Shop	200 s.f.
Office Area	1350 s.f.
Conference Room	75 s.f.
Component Testing & ATD Calibration Lab	2000 s.f.
Hydraulic Pump Room	300 s.f.
Circulation, Restrooms, Support Spaces	500 s.f.
Total	13500 s.f.

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BUDGET ESTIMATE

CONSTRUCTION	Area	Cost/S.F.		
Building/Structure	13500	200	2,700,000	
The Building/Structure line item above includes sitework				
Concrete Reaction Mass			800,000	
				3,500,000

OTHER COSTS		
Architectural/Consultant Fees	262,500	
DOA Permitting Fee	30,000	
Survey and Site Testing	25,000	
Printing & Misc. Expense	22,500	
Security	50,000	
Telecommunications	75,000	
Signage	15,000	
Landscaping	50,000	
Contingency (10% of $2,700,000)	270,000	
		800,000
Dynamic Sled System	3,200,000	
		3,200,000

TOTAL PROJECT BUDGET	**7,500,000**

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PROJECTED SCHEDULE

ID	Task Name	2017					2018												2019											
		A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	Architect Selection																													
2	Design Development																													
3	Construction Documents																													
4	Bidding																													
5	Contract Award																													
6	Construction																													

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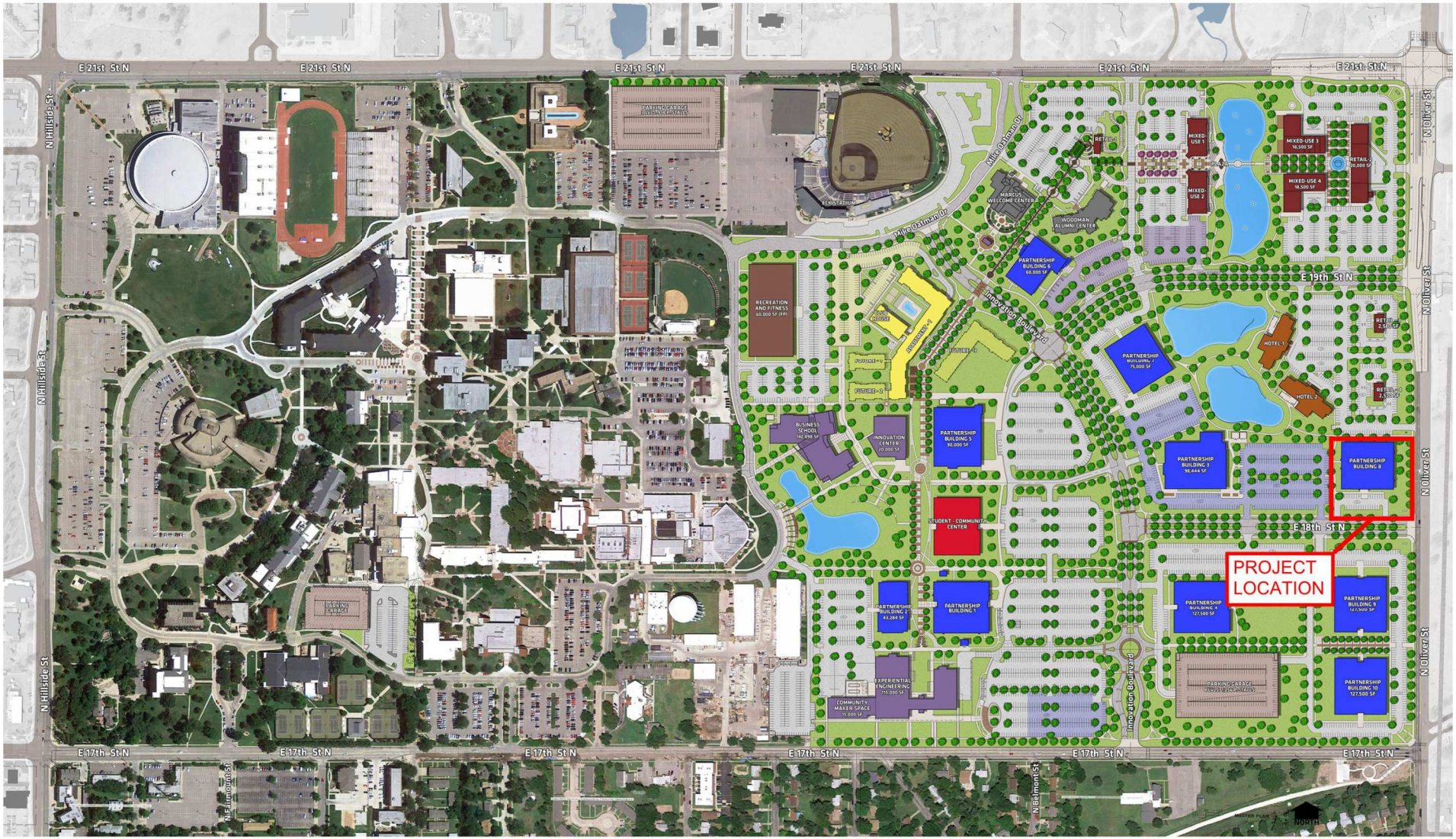
LOCATION MAP



GLMVArchitecture

INNOVATION CAMPUS MASTER PLAN

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WICHITA STATE UNIVERSITY

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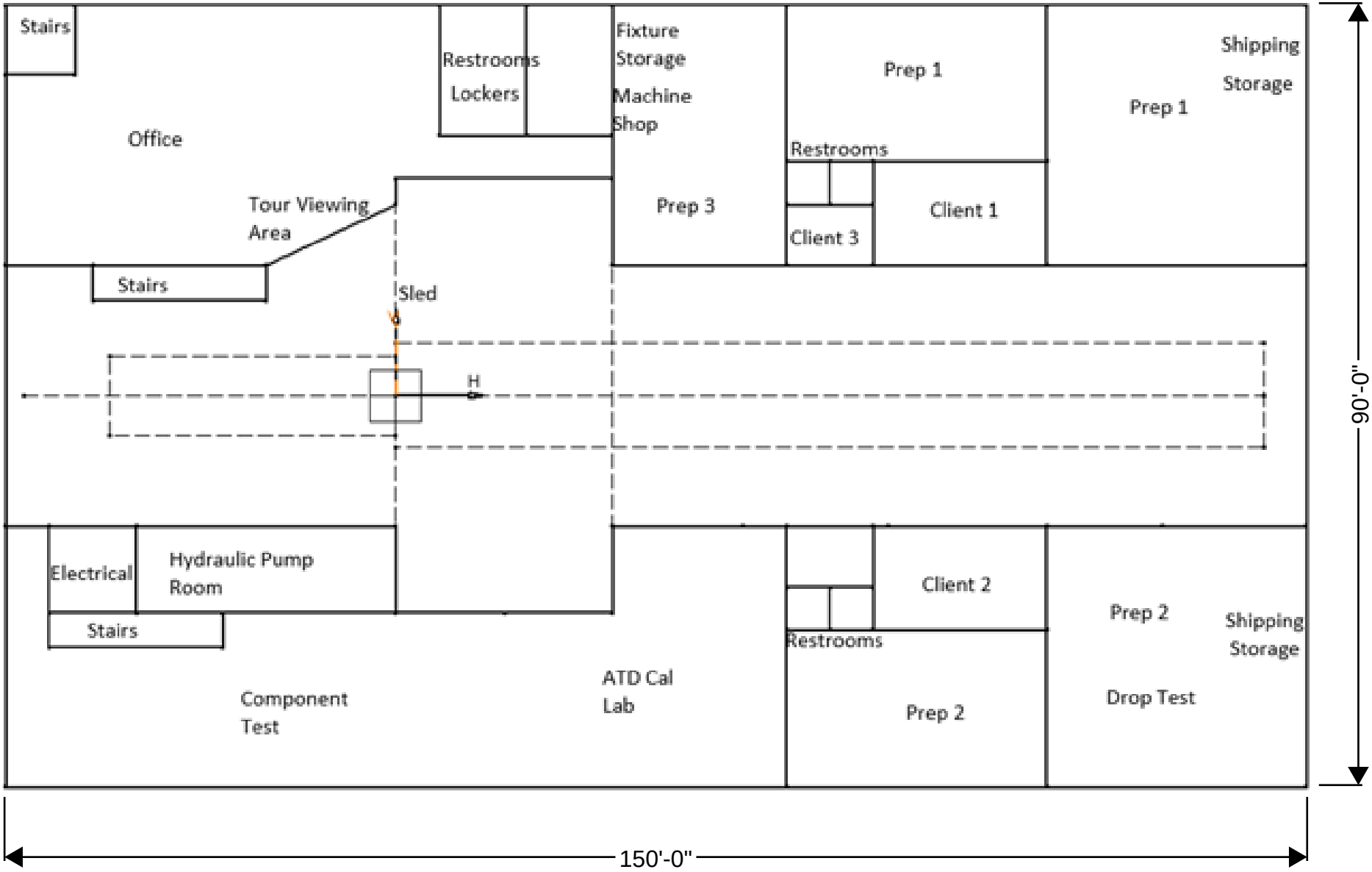
CONCEPTUAL FLOOR PLAN



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SLED SYSTEM PHOTOGRAPH

**PHOTOGRAPH SHOWN FOR REFERENCE ONLY. ACTUAL SLED DESIGN MAY BE DIFFERENT THAN SHOWN.